Sector Installation & Installation Tool

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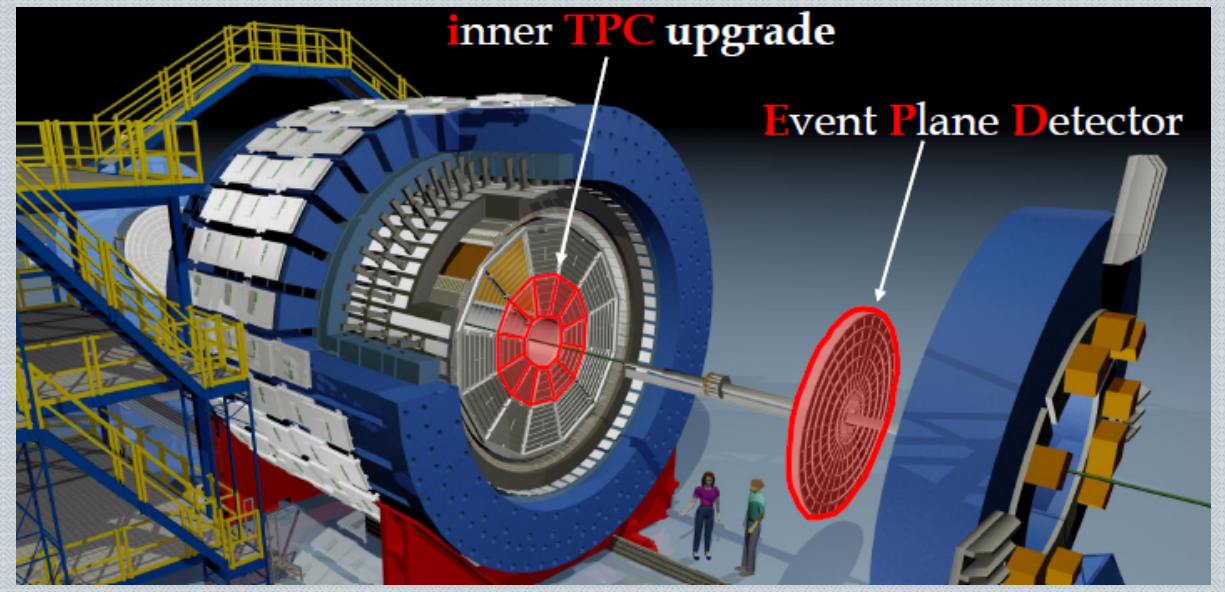

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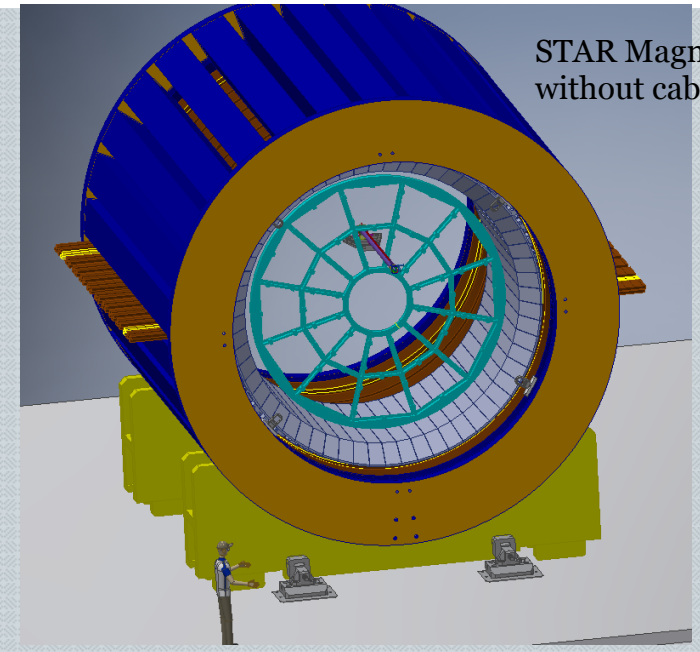
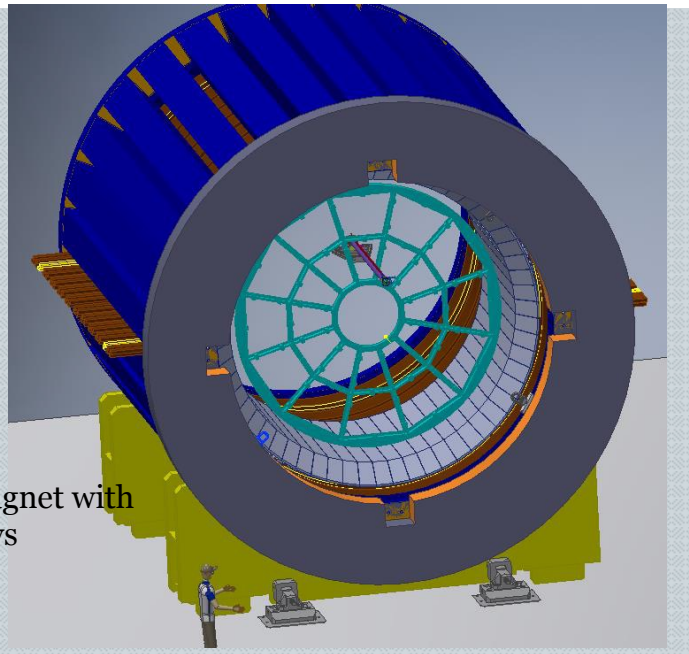
Pre-Requisites and Resources

- STAR Detector must be rolled out to the assembly hall – STSG (STAR Technical Support Group)
- The TPC face should be stripped of the electronics and services – Electronics Group and STSG
- Cleanroom with installation platform needs to be built around the STAR magnet face – C-AD (Collider Accelerator Department) Technicians
- Installation of Sectors – STSG
  - Only two qualified and trained people can be on top of the installation platform at any given time.

Clean Room Construction



STAR Magnet
without cable trays



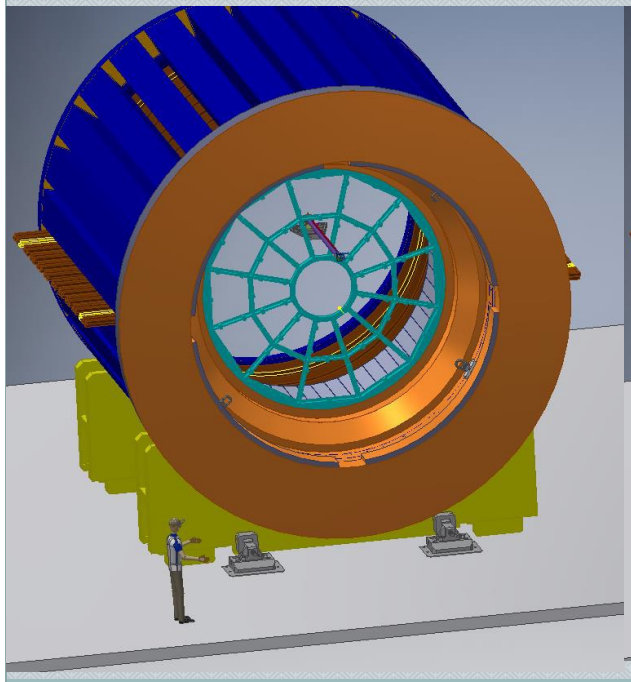
STAR Magnet with
cable trays

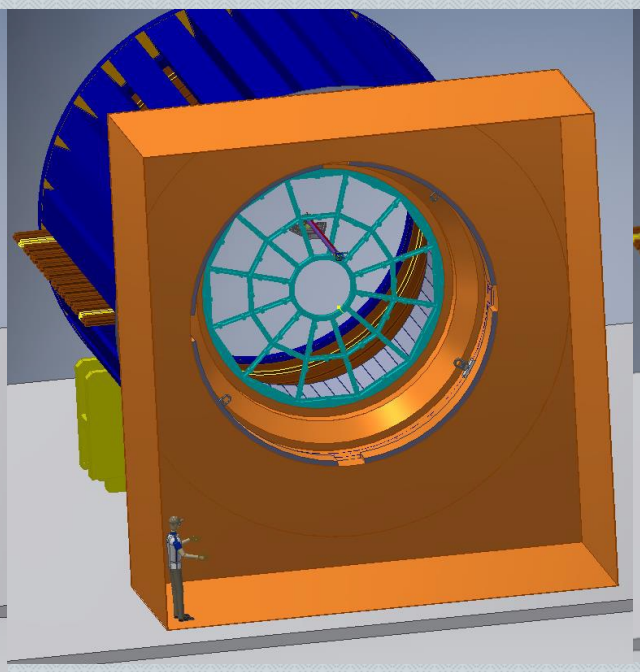
Cleanliness requirements will be met in 2 steps:

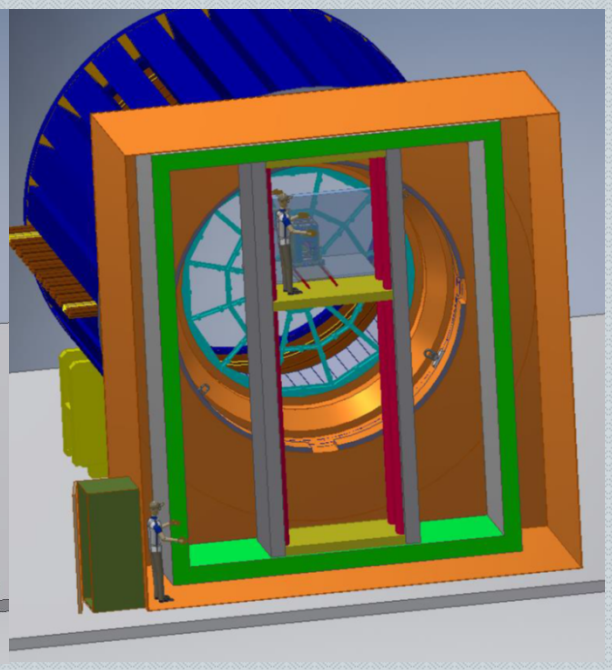
- By building cleanroom around the face of the magnet that will start from TPC face and will keep all the dirty components (cable trays and other dirty surfaces) outside. The enclosure will be constructed from unistrut and transparent vinyl sheeting
- Cover for the opening that will be put in place right after the old sector is taken out and will be removed when new sector is ready for insertion in the opening.
- Clean room will be designed to have slight overpressure of air inside the cleanroom (based on previous experience).

Clean Room Construction

- Step 1) Cover all the dirty cable trays and utilities using clear vinyl sheeting.
- Step 2) Construct framework around magnet face for the cleanroom.
- Step 3) Construct Cleanroom with Installation platform inside it.



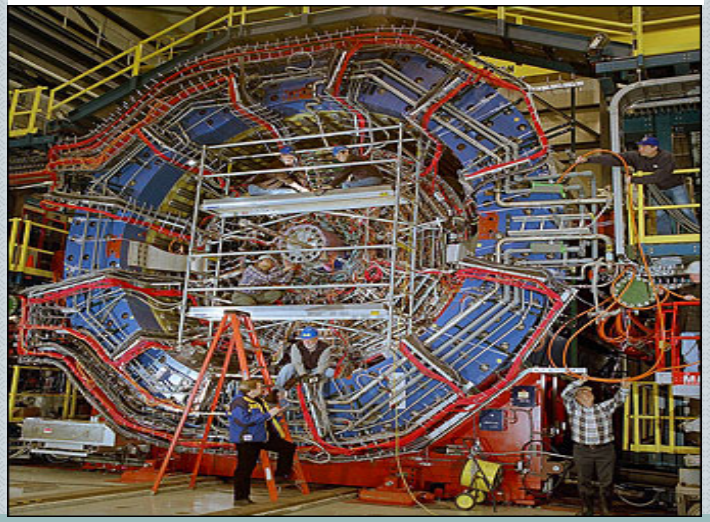




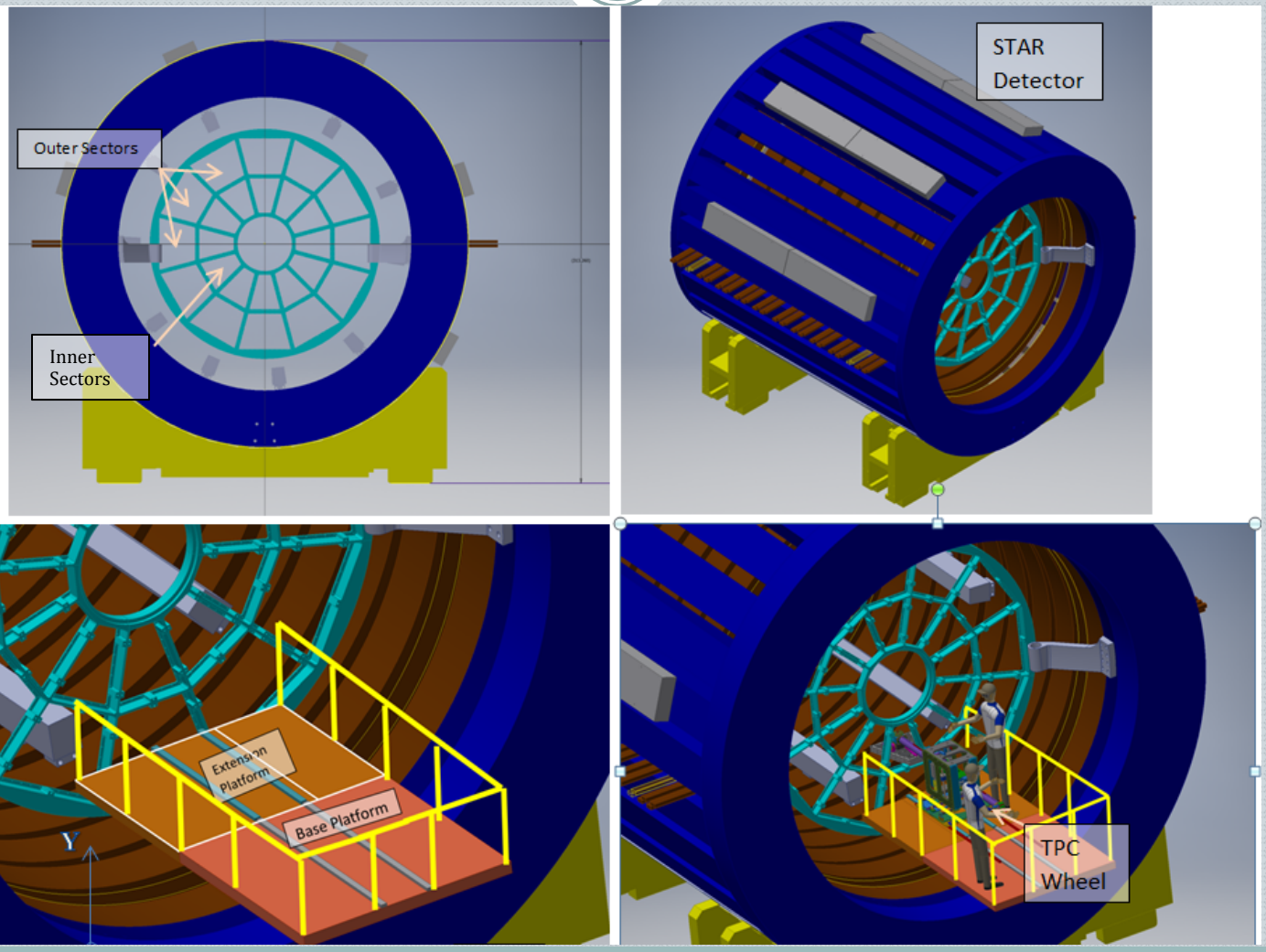
Sector Installation

Why Old setup can't be used?

- No crane access to the TPC face as TPC is offset inside magnet by about 60 inches considering cable trays on the face of the magnet.
- Modifying existing tooling by adding counterweights increase the tooling weight to more than a 2.5times the existing weight of tooling and TPC (made of aluminum) has not enough safety factor to handle that load.



Sector Installation



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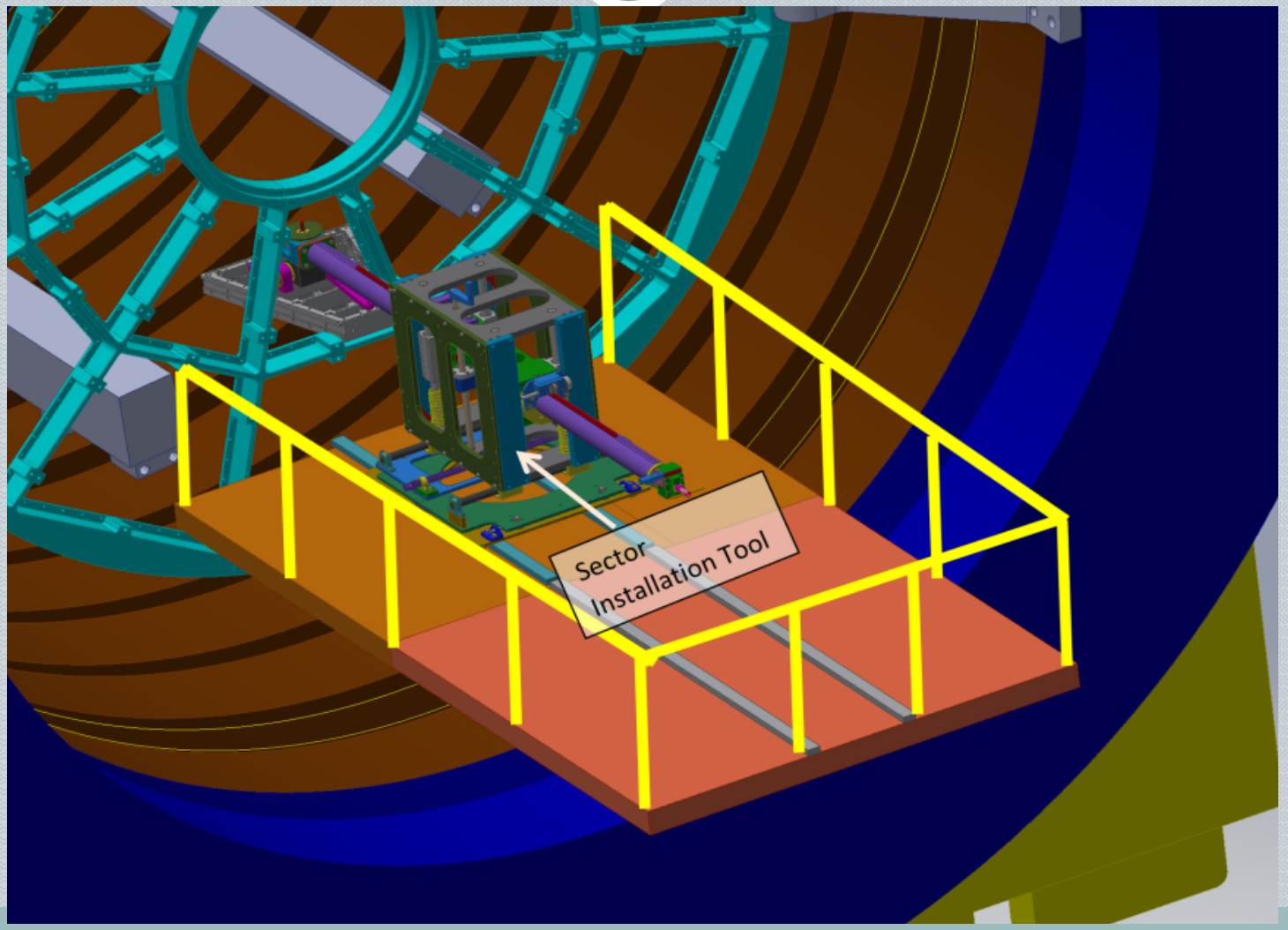

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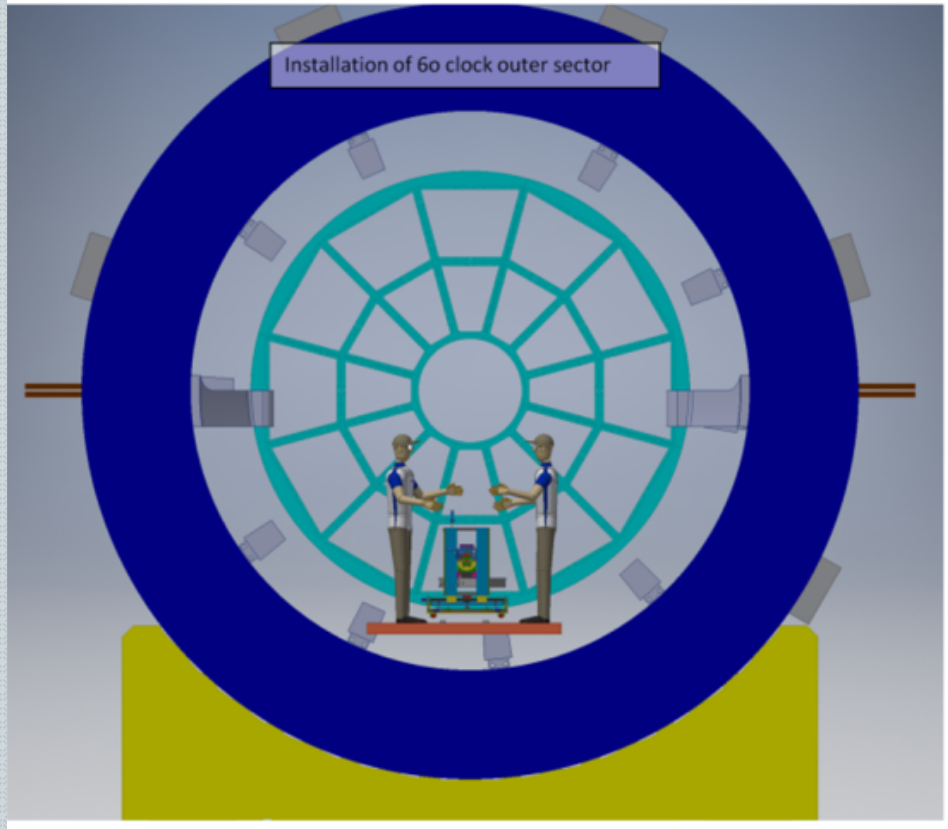

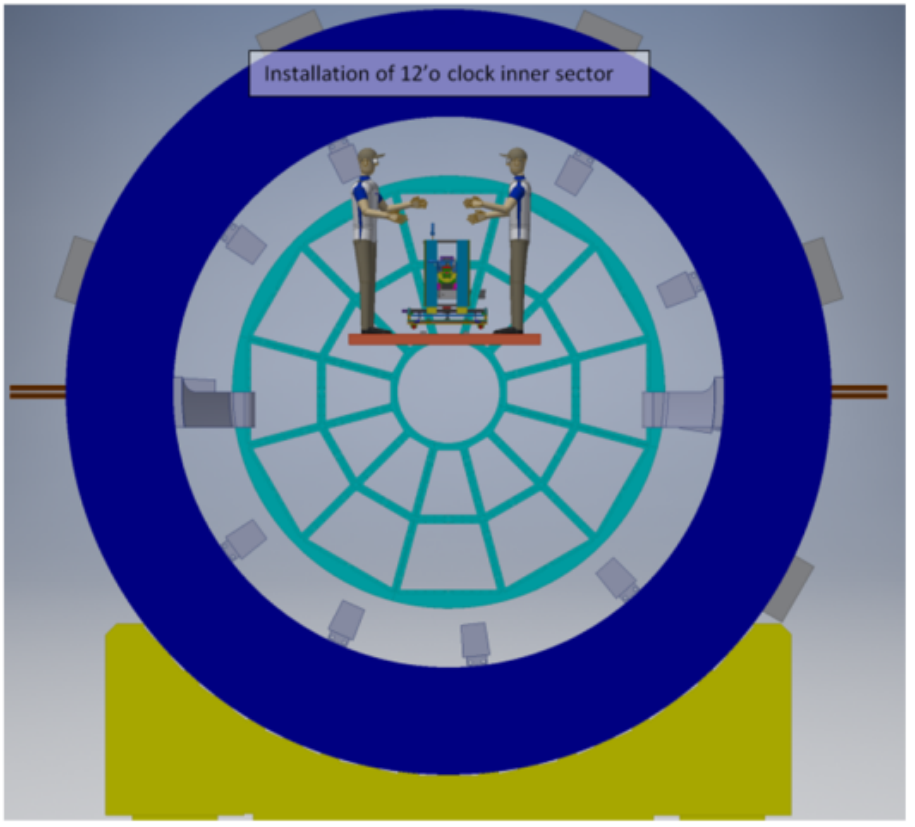

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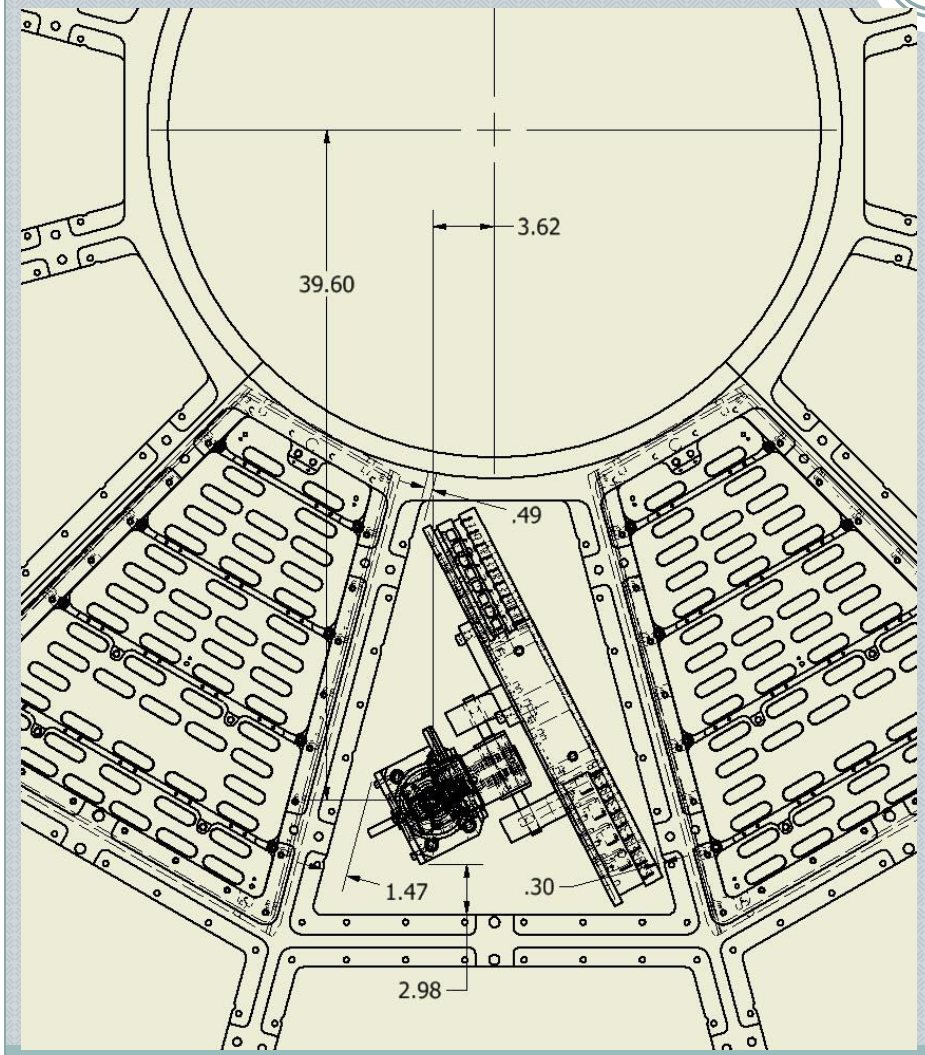
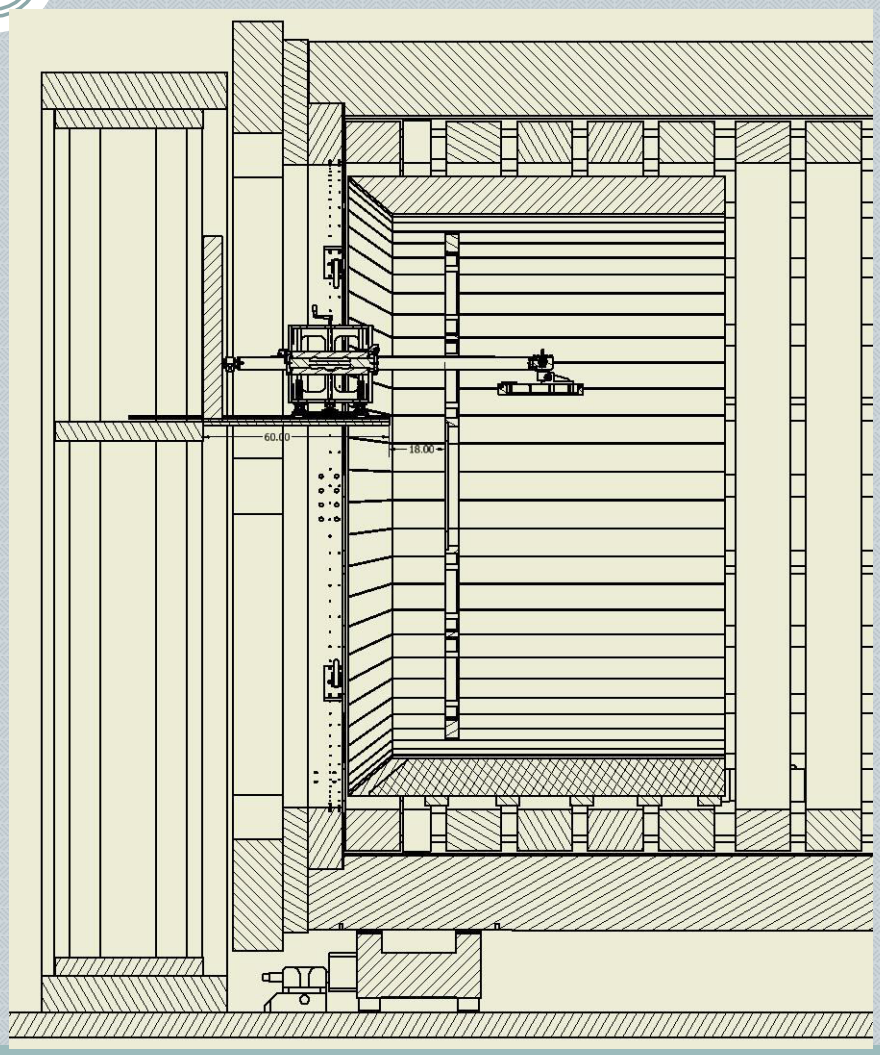
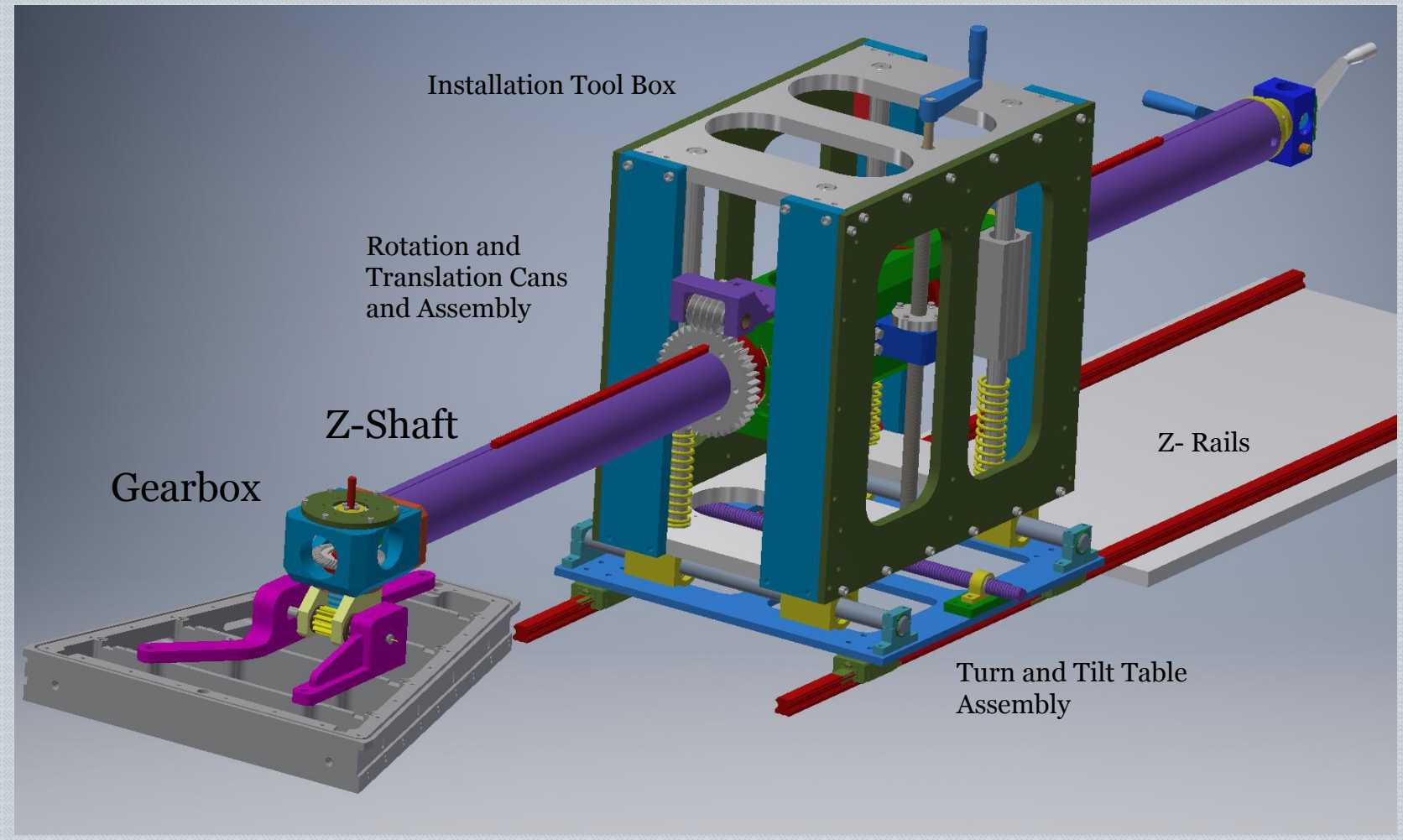
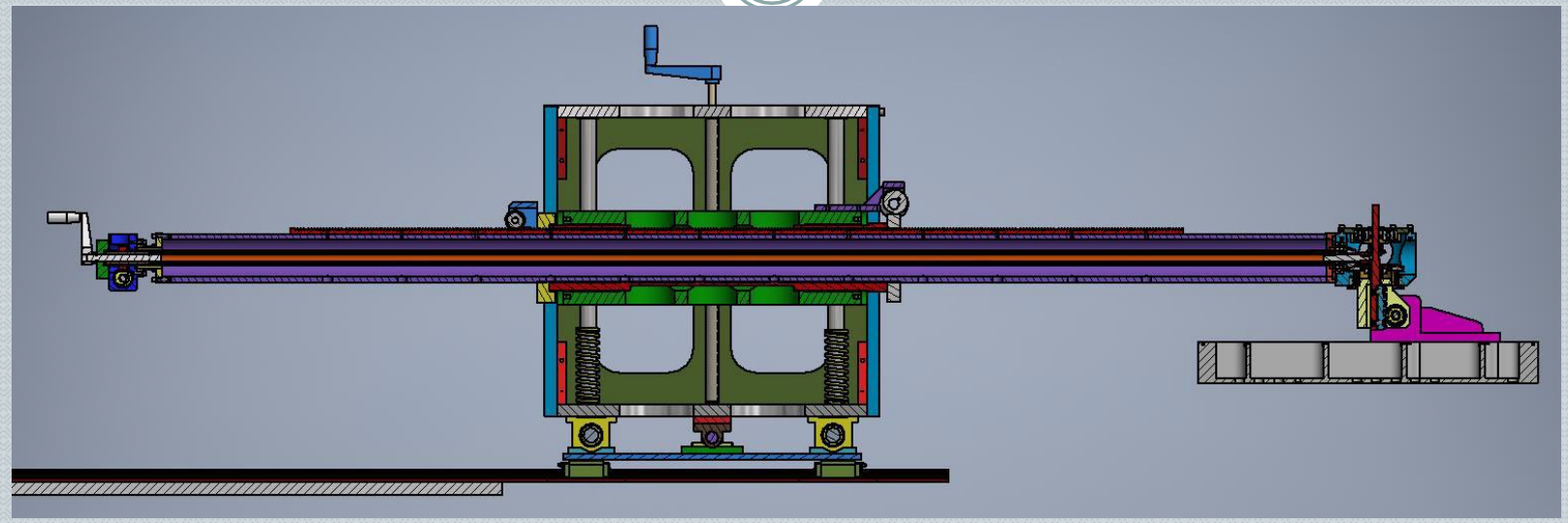


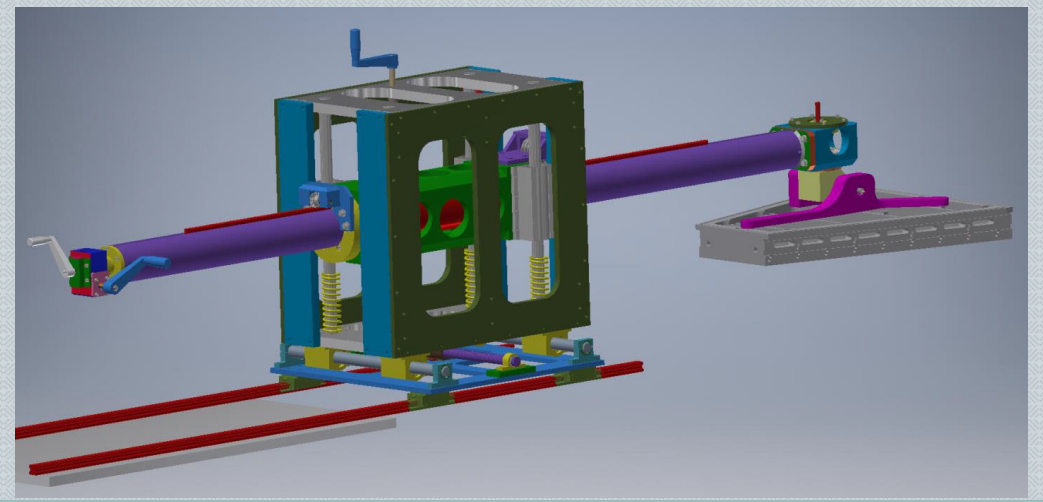


Sector Installation Tool Design

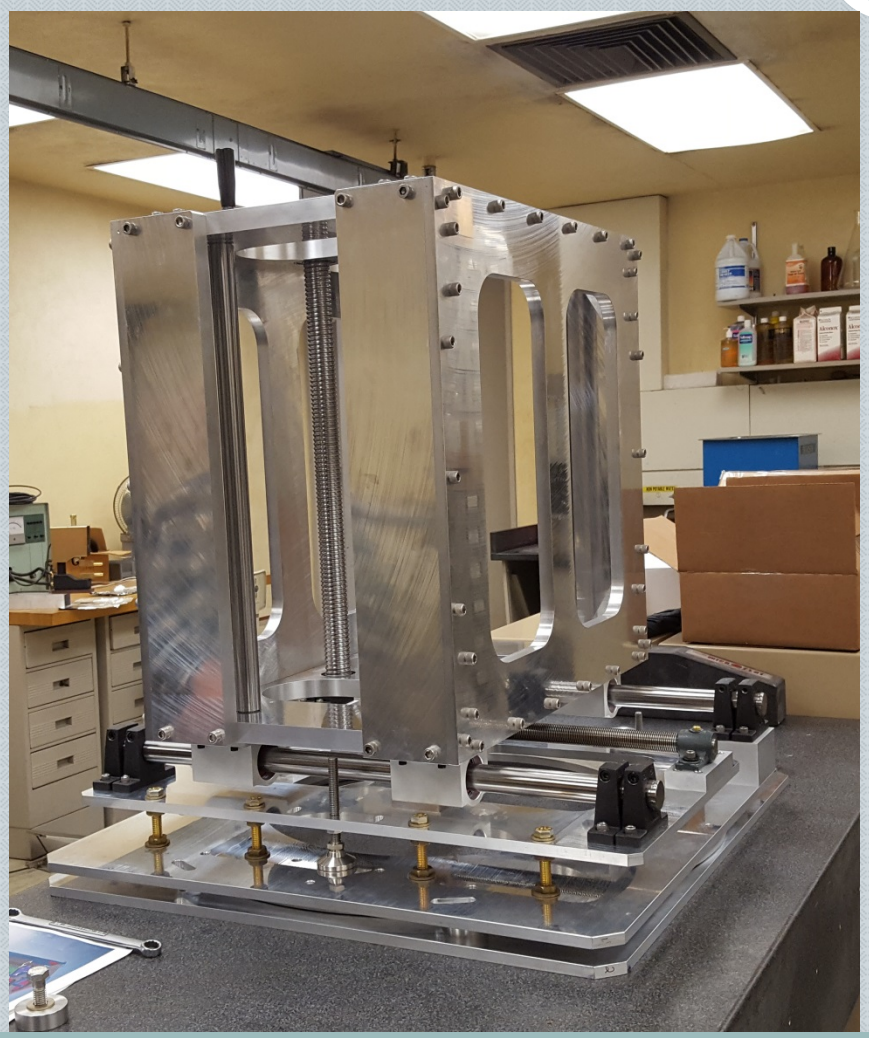


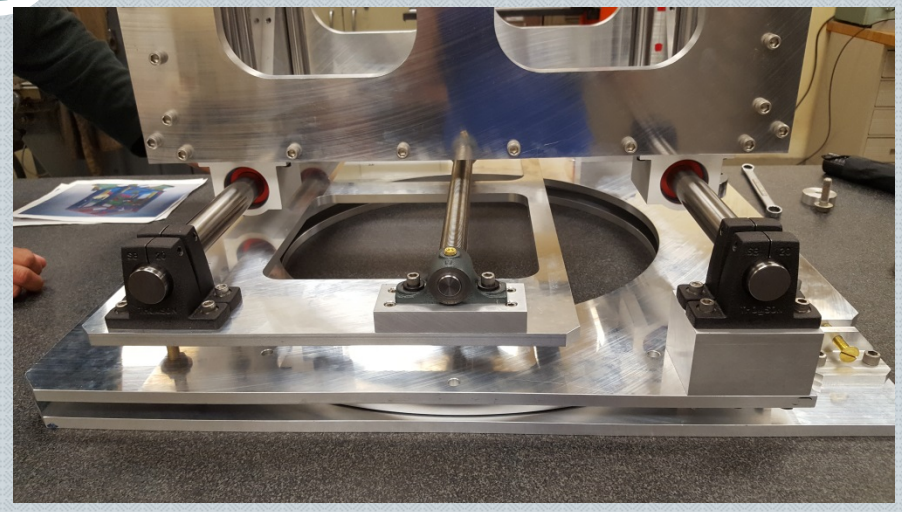
Sector Installation Tool design

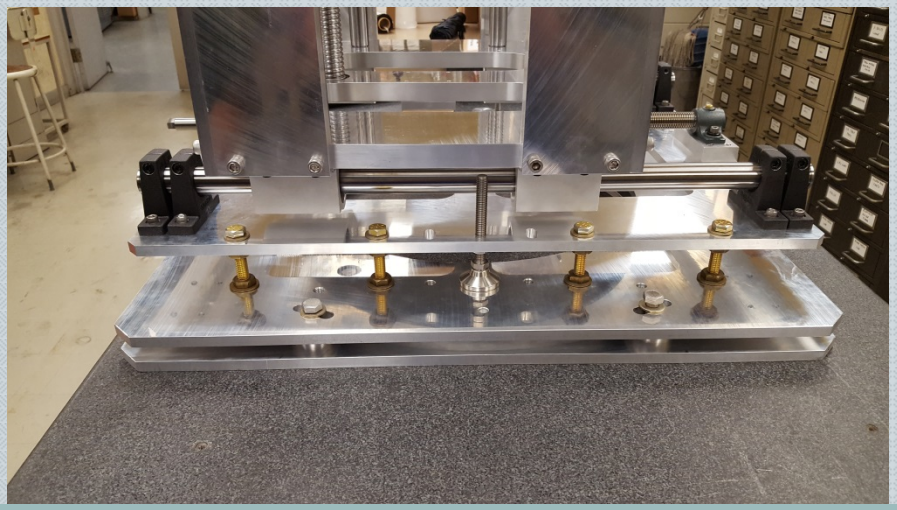




Sector Installation Tool







Sector Installation Toolbox Video

My Movie.wlmp

Milestones for Installation Tool Construction

Task	Completion Date
Platform detailed design start	8/22/2016
Platform fabrication start	12/1/2016
Platform delivery	5/1/2017
Tooling Box completed at BNL	11/1/2016
Gear system design complete	10/15/2016
Insertion Tooling assembled	2/1/2017

Schedule

Task	Completion Date
STAR Roll out after run 17	6/16/2017
Strip Electronics, Prepare Clean Enclosure and Platform (East Side)	8/11/2017
Install One new Sector, Reinstall Electronics	9/5/2017
Testing and Commissioning	10/12/2017
Run 18	11/09/2017
STAR rollout after Run 18	5/16/2018
Strip Electronics, Prepare Clean Enclosure and Platform (East Side)	7/11/2018
Install first 6 Sectors	8/8/2018
Install next 6 sectors	9/5/2018
Strip Electronics, Prepare Clean Enclosure and Platform (West Side)	10/3/2018
Install 6 Sectors	10/31/2018
Install last 6 sectors	11/28/2018
Install East and West Services and Electronics	12/7/2018

Risks and Mitigation

- **Risk 1)** Installation tool not able to provide enough range of motion or degrees of freedom for sector installation with required precision.
- Mitigation Plan - A complete analysis was done on the requirement of range of motion and insertion tool has enough range in all directions. The sector tool and platform will be available well in advance. The tool will be required to complete sector installation process on mockup multiple times making sure it works fine and can complete desired task.
- **Risk 2)** Sector hits the IFC or adjacent sector causing damage during installation.
- Mitigation Plan - The clearance between the sectors is about 3.5mm during installation. A great deal of caution is required during the installation to avoid damaging adjacent sectors and IFC. Deflection in tool components and any vibrations during tool operation can make this problem worse. Mockup design explained in first step will include features mimicking IFC and adjacent sector walls to make sure tool chattering or vibrations are not going to become a problem during actual installation.
- **Risk 3**) Installation tool fails during the installation and causing either sector to fall in the TPC or get stuck in a non retrievable position.
- Mitigation Plan - To mitigate this installation tool components is designed with enough factor of safety. All components will be mechanical and will be hand-cranked to achieve desired motion in a controlled manner. Testing will be done multiple times in all challenging orientations to make sure the tool can achieve desired goals.